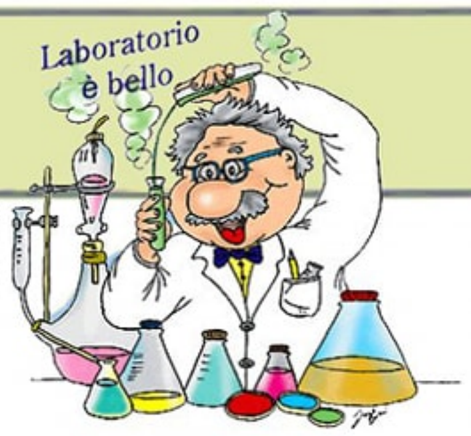


1- A- <u>Choose the correct answer:</u>

1) The energy produced from the conversion of 0.5 u is ……

a. 0.8×10^{-19} Me
b. 465.5 Mev
c. 7.47×10^{-11} Joule
d. (b) and (c)

2) The particle that consists of two down and one upper quarks is the ……

a. Proton
b. neutron
c. electron
d. meson

3) The value of Q for an upper quark (U) is ……

a. Zero
b. $+\frac{1}{3}$
c. $-\frac{1}{3}$
d. $+\frac{2}{3}$

4) In the equation ${}^{4}_{2}\mathrm{He} + {}^{9}_{4}\mathrm{Be} \rightarrow {}^{12}_{6}\mathrm{C} + \mathrm{X}$, X represents a / an ……

a. electron
b. Proton
c. neutron
d. Gama

5) The nucleons are ……

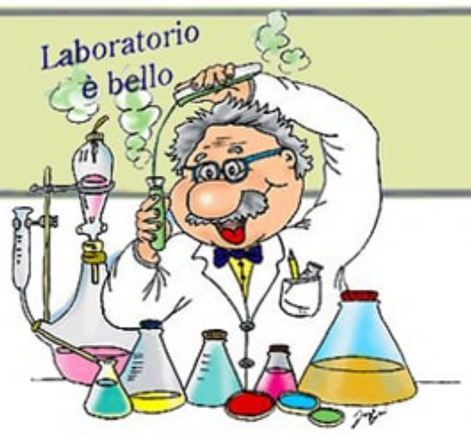
a. alpha and beta particles
b. beta particles and neutrons
c. Neutrons and protons

6) One of the following is not from the properties of the isotopes, they have the same.

a. chemical properties
b. atomic number
c. number of protons
d. number of neutrons

7) The half period of a radioactive element is 2 years, the remained atoms of 4.8×10^{12} atoms after 8 years are ……

a. 2.4×10^{12}
b. 1.2×10^{12}
c. 0.3×10^{12}
d. 4.5×10^{12}



b- Complete the following nuclear equations:

1- $^{235}_{92}u + {}^{1}_{0}n \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}kr + 3{}^{1}_{0}n$

2- $^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{3}_{2}He + {}^{1}_{0}n + 24$ Mev

3- $^{14}_{7}N + {}^{4}_{2}He \rightarrow {}^{17}_{8}O + {}^{1}_{1}H$

4- $^{6}_{3}\ell i + {}^{1}_{0}n \rightarrow {}^{3}_{1}H + {}^{4}_{2}He$

5- $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

6- $^{26}_{12}Mg + {}^{2}_{1}H \rightarrow {}^{24}_{11}Na$

7- $^{27}_{13}Al + {}^{1}_{1}H \rightarrow {}_{11}Na + {}^{4}_{2}He$

2- a- Write the scientific term of each of the following:

1) The primary particles from which protons and neutrons are formed.
(quarks)

2) The time taken for the radioactive element to lose its half number of nuclei " half its mass" (half period)

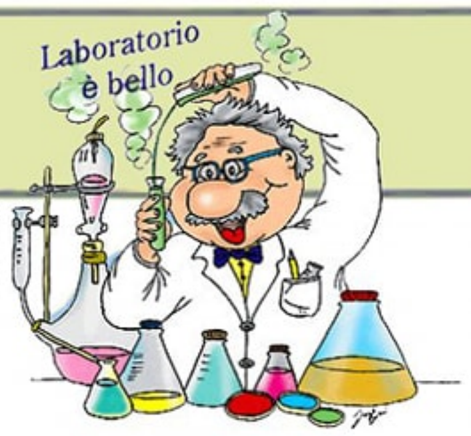
3) Atoms of the same element, have the same atomic number but different neutrons number. (Isotopes)

4) The energy that binds the components of the nucleus.
(Nuclear binding energy)

5) The division of heavy nucleus into two or more nuclei closed in their masses. (Fission reaction)

6) The fusion of two light atom nuclei to produce a hevier nucleus less in mass than the fused nuclei. (Fusion reaction)

7) The reaction that carried out in the nuclear reactor.(Artificial reaction)



8) The hydrogen isotope of a nucleus contains one protons and two neutrons. (Tritium $^{3}_{1}H$)

b- Give reason:

1) The actual mass is less than the calculated mass.

- Because each nucleon contributes with apart of its mass as energy.

2) The charge of proton is (+1)

- Because it consists of two upper and one down quarks ($\frac{+2}{3} + \frac{2}{3} - \frac{1}{3} = +1$

3) Emission of a beta particle from the nucleus increases the atomic number by one.

- Because one of the neutrons transfers into a proton and a beta particle $N \rightarrow P + - i^{e}$

4) The mass of the atom is concentrated in the nucleus.

- Because the masses of protons and neutrons are greater than that of electrons (can be neglected)

3-a- Solve the following problems:

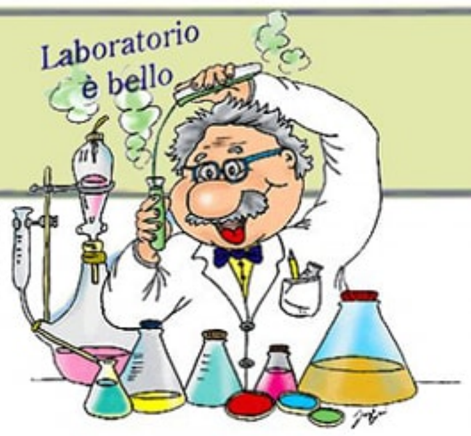
1) Calculate the binding energy per nucleon of helium $^{4}_{2}He$ provided that the actual mass is 4.0015 u and the masses of proton and neutron are 1.0078 and 1.0086 u respectively.

- $^{4}_{2}He$: P = 2 , N = 2

The calculated mass = (2 x 1.0078) + (2 x 1.0086) = 4.0328u

The mass defect = 4.0328 – 4.0015 = 0.0313u

The nuclear binding energy = 0.0313 x 931 = 29.1403 Mev



The binding energy per nucleon = $\frac{29.1403}{4}$ = 7.285 Mev

2) Calculate the produced energy when 5gm is converted. In

a- Joule b- Calorie c- Mev

- The mass in a mu = $\frac{5}{1.66\ x\ 10^{-24}}$ = 3.012 x 10^{24} u

a-E Joule = $\frac{m}{(u)}$ x 14.94 x 10^{-11} = 3.012 x 10^{24} x 14.94 x10^{11} = 44.99 x10^{13}J

b-E clone = $\frac{EJ}{4.18}$ = $\frac{44.99\ x\ 10^{13}}{4.18}$ = 10.755 x 10^{13} Calories

c-E Mev = 3.012 x 10^{24} x 931 = 2804.216 x 10^{24} Mev

3) A radioactive element of mass 10gm and half-life 3 days calculate the remained mass after 6 days.

- No. of periods = $\frac{6}{3}$ = 2 periods

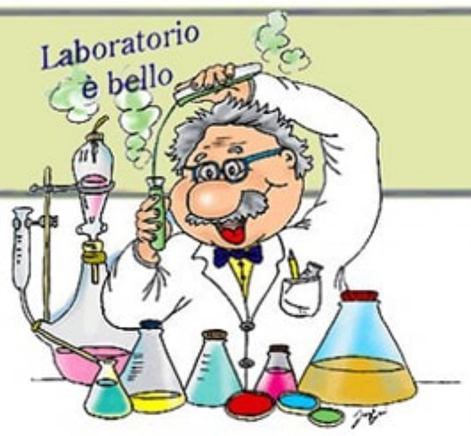
$10_{gm} \xrightarrow{(1)} 5_{gm} \xrightarrow{(2)} 2.5_{gm}$ ∴ the remained mass = 2.5 gm

4) Calculate the time needed to disintegrate 75% of radioactive element , provided that the half-life is 3.82 days

- $100 \xrightarrow{(1)} 50 \xrightarrow{(2)} 25$ ∴ No. of periods = 2

Time needed = 2 x 3.82 = 7.64 days

5) A mass of 12gm of a radioactive substance is placed in somewhere, after 30 days the remained mass is 1.5gm calculate the half-life of this substance.



- $10_{gm} \xrightarrow{(1)} 6_{gm} \xrightarrow{(2)} 3_{gm} \xrightarrow{(3)} 1.5_{gm}$

$\therefore$ Half-life $= \frac{\text{Total time}}{\text{No.of periods}} = \frac{30}{3} = 10$ days

b-1- Mention the contributions of the following:

1) Bequerel: Discovered the radioactive phenomenon.

2) Bohr : Discovered the main energy levels.

3) Ruther ford : Discovered the nucleus.

4) Shad wick : Discovered the neutrons.

2- What is the role of the following in the reactors:

1- Cadmium rods: Controls the nuclear reaction

2- Cooling system " Water " absorbs heat from the core of the reactor.

4- a- Compare between:

Chemical reactions	Nuclear reactions
1- Occur between outermost electrons 2- No new element are formed 3- The isotopes give the same products 4- Small amount of energy is produced	1- Occur between the nuclei of the atoms. 2- New elements are formed 3- The isopes give different products 4- Large amount of energy is produced.

b- $^{220}_{88}Ra$ loses an alpha particle. Write the equation $^{220}_{88}Ra \rightarrow {}^{216}_{88}Rn + {}^{4}_{2}He$

b- Compare between:

P.O.C	Alpha	Beta	Gama
1- Nature of radiation	Particles $^{4}_{2}He$	Particles $^{0}_{-1}e$	Electromagnetic waves
2- Charge	+2	-1	—
3- Ability to permeate	Weak	More than alpha	Strong
4- Ability to ionize	Strong	Less than alpha	Low

EKB questions on chemistry second term

Q1:

The change in energy during a chemical reaction may be explained in terms of electrostatic interactions between subatomic particles. Which of the following best describes the change in energy when a covalent bond is formed?

- A Bond formation absorbs energy due to increased electrostatic attraction between protons and electrons.
- B Bond formation releases energy due to increased electrostatic attraction between protons.
- C Bond formation releases energy due to increased electrostatic attraction between protons and electrons.
- D Bond formation releases energy due to increased electrostatic repulsion between protons.
- E Bond formation absorbs energy due to increased electrostatic repulsion between protons and electrons.

Q2:

What name and symbol are given to the overall change in energy at constant pressure during a chemical reaction?

- A Potential difference, ΔV
- B Temperature change, ΔT
- C Enthalpy change, ΔH
- D Entropy change, ΔS
- E Activation energy, E□

Q3:

Which of these statements does **not** describe the conservation of energy in a chemical reaction?

- A Energy is neither created nor destroyed during a chemical reaction.
- B The energy contained in the bonds of reactant molecules always equals the energy contained in the bonds of product molecules.
- C If the energy of a system increases, then the energy of the surroundings decreases by the exact same amount.
- D Energy can only be transferred from one form to another.

- E If the energy of a system decreases, then the energy of the surroundings increases by the exact same amount.

Q4:

Why do chemical reactions usually involve a change in energy?

- A The process of making or breaking bonds during a chemical reaction absorbs and releases energy.
- B The process of splitting the nucleus of an atom releases large amounts of energy.
- C In chemical reactions, atoms are destroyed and converted into energy.
- D The nuclei move faster during chemical reactions and so require more energy.

Q5:

Which of the following is **not** a type of energy that a chemical reaction may produce?

- A Light
- B Electric
- C Color
- D Heat
- E Chemical

Q6:

The reaction of calcium oxide with water produces calcium hydroxide and releases 57.3 kJ of energy. How much energy is released when 10 g of calcium oxide is reacted with excess water? Give your answer to 1 decimal place.

……
…….

Q7:

The value of ΔH when liquid water freezes to solid water is −6.01 kJ/mol.What is the value of ΔH when solid water melts to liquid water?

……
…….

Q10:

Fuels can also be used to provide energy. Which of the following fuels does **not** produce energy through a chemical reaction?

- A Biofuels
- B Fuel cells
- C Nuclear fuel
- D Fossil fuel
- E Batteries

Q11:

The molar bond energy of F2 is 159 kJ/mol.Calculate the energy of one FF bond.

- A 1.65×10^{3}
- B 2.64×10^{3}
- C 9.58×10^{3}
- D 3.79×10^{3}
- E 2.55×10^{3}

- **Q12:**

What is Avogadro's number to 2 decimal places?

- A $6.02\times10\square\square$
- B $6.71\times10\square\square$
- C $10.0\square$
- D 3.14
- E $1.38\times10\square\square\square$

Q13:

3.70 mol of ClCl bonds release 888 kJ of energy when they form. How much energy is released when 1000ClCl bonds form?

- A $3.99\times10\square\square\square$ J
- B $1.48\times10\square\square\square$ J
- C $3.99\times10\square\square\square$ J
- D $1.48\times10\square\square\square$ J
- E $4.01\times10\square\square\square$ J

Q14:

Which of the following quantities of bonds requires the most energy to break?

- A 5.8molII(148kJ/mol)
- B 1.0molCC(835kJ/mol)
- C 2.0molHCl(428kJ/mol)
- D 2.0molHH(436kJ/mol)
- E 1.7molOO(494kJ/mol)

Q15:

Every molecule of iodine, I2,has an iodine–iodine bond, II.The energy required to break one of these bonds is 2.51×10□□□ J.How much energy is required to break 1.00 mole of these I–I bonds?

- A 4.17×10□□□ J
- B 3.44×10□□ J
- C 1.51×10□ J
- D 2.51×10□□□ J
- E 9.01×10□□ J

Q16:

The energy of the hydrogen–hydrogen bond in H2 is 436 kJ/mol.Which of the following is an equivalent description of the bond energy in hydrogen?

- A 436 kJ of energy is required to form the hydrogen–hydrogen bonds of 6.02×10□□ hydrogen molecules.
- B For every hydrogen–hydrogen bond in a hydrogen molecule formed, 436 kJ of energy is released.
- C 436 kJ of energy is released when the hydrogen–hydrogen bonds of 6.02×10□□ hydrogen molecules are broken.
- D For every hydrogen–hydrogen bond in a hydrogen molecule broken, 436 kJ of energy is released.
- E 436 kJ of energy is required to break the hydrogen–hydrogen bonds of 6.02×10□□ hydrogen molecules.

Q17:

It takes approximately 2.757×10□□□ J of energy to break all the bonds in a single molecule of methane, CH4.What is the average molar bond energy for CH bonds? Give your answer to the nearest whole number.

Q18:

The specific heat capacity of a substance is usually given in units of joules per gram per degree Celsius. From these units, which of the following statements best describes specific heat capacity?

- A The amount of energy needed to raise the temperature of 1 gram of a substance by 1∘C
- B The temperature of a substance that is equal to the amount of energy multiplied by its mass
- C The amount of substance that can be produced when one joule of energy is raised by 1∘C
- D The amount of energy formed when 1 gram of a substance reaches a specific temperature
- E The mass of a substance needed to raise the temperature by 1∘C

Q19:

A single HBr bond has an energy of 6.14×10□□□J.What is the molar bond energy for HBr?Give your answer to the nearest whole number.

Q20:

What is the SI unit for energy?

- A Joule (J)
- B Mole (mol)
- C Watt (W)
- D Kilogram (kg)
- E Electron volt (eV)

Q21:

In an experiment, 14.9 g of potassium chloride was added to 150 mL of water at 22∘C.The change in temperature was recorded and is shown in the graph below.

By drawing a line of best fit between the data points from 0 to 40 seconds,which of the following is the temperature at 40 seconds?

- A 22∘C
- B 21.4∘C
- C 22.2∘C
- D 20.5∘C
- E 18.0∘C

By drawing a line of best fit between the data points from 75 to 120 seconds and extrapolating, which of the following is the temperature at 40 seconds?

- A 18.0∘C
- B 17.0∘C
- C 17.5∘C
- D 18.4∘C
- E 17.9∘C

Using the two lines of best fit, calculate the change in temperature at 40 seconds.

Determine the value of ΔH for this reaction, taking the specific heat capacity of water to be 4.2/·JgC∘.Give your answer in units of kilojoules per mole and to 1 decimal place. Remember to include a sign in your answer. [K=39g/mol,Cl=35.5g/mol]

Q22:

When 50 mL of water containing 0.5 M HSO24 at 20∘C was mixed with 50 mL of water containing 0.5 M NaOH at 20∘C,the highest temperature recorded was 26∘C.

What is the value of q for this reaction? Use a value of 4.2/·JgC∘ for the specific heat capacity of water. Give your answer in joules.

If NaOH is the limiting reagent, what is the value of q in kilojoules per mole of NaOH?[Na=23g/mol,H=1g/mol,O=16g/mol]

The balanced equation for the reaction isHSO()+2NaOH()NaSO()+2HO()24242aqaqaqaqWhat is the molar enthalpy change for each mole of HSO24 consumed? Give your answer as a whole number.

Q23:

A student wants to take 150 mL of water at 25∘C and boil it. They are given some fuel that produces 6.75 kJ of heat energy per 1 g of fuel burned. How much fuel does the student need to burn in order for the water to reach its boiling point? Give your answer to the nearest whole number. Assume the heat capacity of water remains constant.

…….

Q24:

An experiment is carried out using calorimetry to compare the heat released from a range of different fuels. Which of the following factors does **not** need to be kept constant when repeating the experiment for each different fuel?

- A Same mass of fuel burnt

- B Thermometer
- C Volume of the water
- D Starting temperature of the water
- E Same burner and wick

Q25:

The diagram below shows the experimental setup for a simple calorimeter to measure the enthalpy change in certain reactions. For which type of reaction would this experimental apparatus **not** be suitable for measuring the change in enthalpy?

- A Dissolution
- B Combustion
- C Displacement
- D Neutralization
- E Precipitation

Q26:

When burned, 40.1 g of methane (M=16.04/□gmol) was found to raise the temperature of 10 kg of water by 53∘C.What is the molar enthalpy change, to the nearest whole number, for the combustion of methane? Take the specific heat capacity of water to be 4.2/·JgC∘.

Q27:

In an experiment, 80 g of water was measured, placed into a copper container, and its temperature recorded. A spirit lamp containing a fuel was weighed and then placed underneath the copper container. The wick of the spirit lamp was lit, and the water was heated until the temperature reached 50∘C.The flame was then extinguished, and the final temperature of the water was recorded. The spirit lamp was then also weighed. The results are listed in the table below.

Initial temperature of water (∘C)	Final temperature of water (∘C)	Mass of spirit lamp before heating (g)	Mass of spirit lamp after heating (g)
22.5	51.2	54.38	52.88

What is the value of q,the heat energy transferred, in the experiment? Give your answer in units of kilojoules and to 1 decimal place. Use a value of 4.18/·JgC∘ for the specific heat capacity of water.

What is the heat change per gram of fuel? Give your answer in units of kilojoules per gram of fuel.

- A 2.2 kJ/g of fuel
- B 14.4 kJ/g of fuel
- C 8.1 kJ/g of fuel
- D 11.4 kJ/g of fuel
- E 6.4 kJ/g of fuel

Q28:

Which of the following equations can be used with the results from a calorimetry experiment to calculate the heat energy transferred during a chemical reaction?

- A $q=(c\times\Delta T)m$
- B $q=mc\times\Delta T$
- C $q=m\times c\times\Delta T$
- D $q=cm\times\Delta T$
- E $q=(m\times c)\Delta T$

Q29:

A student sets up an experiment using calorimetry to measure the enthalpy change of a neutralization reaction. Instead of a polystyrene cup, the student decides to use a glass beaker. How will this affect the results of the experiment?

- A The reaction will be quicker in the glass beaker, causing the change in temperature to be quicker.
- B The temperature change will be higher, as the glass beaker is more insulating than the polystyrene cup.
- C The temperature change will be lower, as more heat will be lost through the glass beaker to the surroundings.
- D The beaker has a higher mass than the polystyrene cup, so the amount of heat energy transferred will be greater.
- E The increase in temperature will cause the glass beaker to crack.

Q30:

A student is setting up an experiment to measure the enthalpy change in a neutralization reaction between hydrochloric acid and potassium hydroxide. Before mixing the two solutions together in a polystyrene cup, the student places a beaker of each solution in a water bath set to 25∘C.Why does the student do this?

- A To ensure the reactants have the correct activation energy needed to react
- B To make the solutions less viscous

- C To ensure both solutions are at the same temperature as each other
- D To increase the rate of reaction between the hydrochloric acid and the potassium hydroxide
- E To remove any impurities in the solutions

Q31:

A chemical reaction has a reaction enthalpy of +430 kJ/mol.Is it endothermic or exothermic?

- A Exothermic
- B Endothermic

Q32:

Which of the following is the best definition of an exothermic reaction?

- A A reaction that is accelerated by cooling
- B A reaction that gives out heat
- C A reaction that is accelerated by heating
- D A reaction that is spontaneous
- E A reaction that absorbs heat

Q33:

A chemical reaction has a reaction enthalpy of −512 kJ/mol.Is it endothermic or exothermic?

- A Endothermic
- B Exothermic

Q34:

Which of the following is the best definition of an endothermic reaction?

- A A reaction that gives out heat
- B A reaction that is accelerated by heating
- C A reaction that is accelerated by cooling
- D A reaction that is spontaneous
- E A reaction that absorbs heat

Q35:

The complete combustion of methanol proceeds according to the equation:2CHOH+3O2CO+4HO3222

The reaction enthalpy is −715 kJ/mol.Is the combustion of methanol endothermic or exothermic?

- A Exothermic
- B Endothermic

Q36:

The thermal decomposition of calcium carbonate proceeds according to the equation:CaCOCaO+CO32The reaction enthalpy is +110 kJ/mol.Is the thermal decomposition of calcium carbonate endothermic or exothermic?

- A Endothermic
- B Exothermic

Q37:

Consider the chemical reaction equation shown.

Is this reaction endothermic or exothermic?

- A Exothermic
- B Endothermic

Q38:

When 10 mL of petrol freezes at −57∘C,the total amount of heat transferred is approximately 1 kJ.However, 300 kJ of heat is transferred when the same volume of petrol is burned at room temperature. Why does combustion result in a greater transfer of heat than freezing?

- A Freezing is exothermic, while combustion is endothermic.
- B Bonds broken during combustion are weaker than those broken during freezing.
- C Bonds formed during combustion are stronger than those formed during freezing.
- D Combustion occurs at a higher temperature than freezing.
- E Freezing is endothermic, while combustion is exothermic.

Q39:

When reporting an experiment, a student writes that “combustion is an exothermic reaction because energy is produced in the form of heat.”

Why is this description **not** correct?

- A There are no energy changes during an exothermic reaction.
- B Combustion is an endothermic reaction.

- C Heat is not a form of energy.
- D Energy cannot be produced.
- E Exothermic reactions absorb heat.

Which of the following is a more accurate description of the combustion reaction?

- A Combustion is an endothermic reaction because energy is produced in the form of heat.
- B Combustion is an exothermic reaction because energy is not produced.
- C Combustion is an exothermic reaction because chemical energy is converted to heat.
- D Combustion is an exothermic reaction because heat is converted to chemical energy.
- E Combustion is an endothermic reaction because thermal energy is released.

Q40:

Exothermic and endothermic reactions both involve changes in bond strength and chemical potential energy.

Which of the following is the best definition of chemical potential energy?

- A The energy that can be released through the formation of chemical bonds
- B The energy stored in the vibration of chemical bonds
- C The energy that can be released through the breaking of chemical bonds
- D The energy stored in the movement of molecules
- E The energy that must be absorbed to form chemical bonds

How do bond strength and chemical potential energy change during an exothermic reaction?

- A Bond strength decreases and chemical potential energy increases.
- B Bond strength remains constant and chemical potential energy increases.
- C Bond strength and chemical potential energy both increase.
- D Bond strength and chemical potential energy both decrease.
- E Bond strength increases and chemical potential energy decreases.

Q41:

Shown in the reaction profile are the changes in chemical energy during a reaction.

Energy cannot be created nor destroyed, only changed from one form to another. Which of the following processes is least likely to occur due to the change in chemical energy shown in the figure?

- A The container for the reaction mixture vibrates less rapidly.
- B Air molecules above the reaction mixture increase in temperature.
- C Light is emitted by reacting molecules.
- D Reactant and product molecules gain kinetic energy.
- E Solvent evaporates from the reaction mixture.

Q42:

Labelled in the diagram are the chemical energies of three compounds, a–c.

Which of the labelled compounds is highest in energy?

- A c
- B b
- C a

Which of the labelled compounds is lowest in energy?

- A b
- B a
- C c

Which of the labelled compounds is most stable?

- A c
- B a
- C b

Which of the labelled compounds is least stable?

- A b
- B a
- C c

Q43:

Illustrated in the reaction profiles are the changes in chemical energy during a range of processes.

Which of the diagrams best describes the changes in chemical energy for a stick of dynamite during an explosion?

- A (b)
- B (a)
- C (c)

Which of the diagrams best describes the changes in chemical energy for a packet of pasta stored in a kitchen cupboard?

- A (b)
- B (a)
- C (c)

Which of the diagrams best describes the changes in chemical energy for a piece of aluminum being heated by a blowtorch?

- A (a)
- B (b)
- C (c)

Which of the diagrams best describes the changes in chemical energy for a tank of burning petrol?

- A (a)
- B (b)
- C (c)

Q44:

A reaction profile shows the relative energies of chemicals in a chemical reaction.

Shown in the reaction profile are the relative energies of chemicals in a simple chemical reaction.

Which components of a chemical reaction are indicated by A?

- A Intermediates
- B Catalysts
- C Products
- D Transition states
- E Reactants

Which components of a chemical reaction are indicated by B?

- A Transition states
- B Reactants
- C Products
- D Catalysts
- E Intermediates

Which components have more energy, those at A or those at B?

- A Those at A have more energy.
- B Those at B have more energy.

Which components are more stable, those at A or those at B?

- A Those at B are more stable.
- B Those at A are more stable.

Would this reaction happen spontaneously?

- A More information is needed.
- B No
- C Yes

Q45:

Illustrated in the reaction profile are the changes in chemical energy during a reaction as the reactant molecules are converted to products.

Based on the reaction profile, is energy absorbed or released during the reaction?

- A Released
- B More information is needed.
- C Absorbed

Q46:

Illustrated in the reaction profile are the changes in chemical energy as reacting molecules are converted to products.

Which of the following is the best description of this chemical reaction?

- A Energy is absorbed by the reaction and the products are more stable than the reactants.
- B Energy is absorbed by the reaction and the products are less stable than the reactants.
- C Energy is released by the reaction and the products are less stable than the reactants.
- D Energy is released by the reaction and the products are more stable than the reactants.

Q47:

The reaction profile diagram for a two-step chemical reaction is shown below. In step 1, compound a reacts to form compound b, and in step 2, compound b reacts to form compound c.

Which step has the highest activation energy?

- A Step 1 and step 2 have equal activation energies.
- B Step 2
- C Step 1

Which step is an exothermic reaction?

- A Neither step 1 nor step 2
- B Step 2
- C Step 1

Q48:

The reaction profile for a chemical reaction is shown in the diagram below. Which label corresponds to the activation energy?

- A None of the labels
- B C
- C B
- D A

Q49:

The reaction profile for a chemical reaction is shown in the diagram below. Which label corresponds to the change in enthalpy, ΔH,of the reaction?

- A A
- B None of the labels
- C B
- D C

Q50:

The reaction profile diagram below shows that graphite is more stable than diamond. However, the conversion from diamond to graphite is very difficult. Which of the following statements explains why?

- A Diamond does not conduct electricity.
- B The energy required to break the covalent bonds between carbon atoms is low.
- C The reaction is exothermic, not endothermic.
- D The energy difference between diamond and graphite is very small.
- E The activation energy for the conversion of diamond into graphite is very high.

Q51:

To the nearest kilojoule per mole, find the bond energy of HCl:H()+Cl()2HCl()kJmol22rgggΔH=−184.7/⊖

Bond	HH	ClCl
Bond Energy (kJ/mol)	436	243

Q52:

Ethene and iodine react to form 1,2-diiodoethane. The equation for this reaction is shown.

+CHCHHHIIHCHICHIH

The total energy change per mole of ethene reacted is −24 kJ/mol.The energies of selected bonds in the reactants and products are given in the table.

Bond	C–C	CC	C–H	II
Energy (kJ/mol)	346	602	411	148

Calculate, to the nearest kilojoules per mole,the bond energy of the C–I bond.

Q53:

Which of the following hydrogen halides has the smallest bond enthalpy?

- A HI
- B HF
- C HBr
- D HCl

Q54:

Which of the following diatomic systems has the largest bond enthalpy?

- A CO
- B SnO
- C GeO
- D PbO
- E SiO

Q55:

Ammonia (NH3) is a key starting material for the manufacture of fertilizers. The compound is produced by the reaction of nitrogen and hydrogen gases at high temperature and pressure. The energies of selected bonds are given in the table.

Bond	N–N	NN	NN	H–H
Energy (kJ/mol)	167	418	942	432

The total energy change per mole of ammonia produced is −46 kJ/mol.Calculate, to the nearest kJ/mol,the energy of the N–H bond in NH3.

Q56:

Nitric oxide (NO) is produced by the reaction of nitrogen and oxygen in the air during a lightning strike. The equation for this reaction is as shown:N+O2NO22

The total energy change for this reaction per mole of nitrogen reacted is +185 kJ/mol.The energies of selected bonds are given in the table.

Bond	N–N	NN	NN	OO
Energy (kJ/mol)	167	418	942	494

Calculate, to the nearest kilojoule per mole (kJ/mol), the energy of the N–O bond.

Q57:

Chlorine gas reacts with hydrogen bromide to produce bromine and hydrogen chloride. The reaction of 1 mole of chlorine releases 82 kJ of energy. The energies of selected bonds in the reactants and products are given in the table.

Bond	H–Cl	H–Br	Cl–Cl
Energy (kJ/mol)	428	362	240

Write a balanced chemical equation for this reaction.

- A Cl+2HBrBr+2HCl22
- B 2Cl+HBr2Br+HCl22
- C Br+HClCl+HBr22
- D Br+2HClCl+2HBr22
- E Cl+HBrBr+HCl22

Calculate, to the nearest kilojoule per mole (kJ/mol), the energy of the Br–Br bond.

Q58:

Ethanethiol, a volatile liquid with a strong smell, is added to liquefied petroleum gas to aid the detection of gas leaks. The compound is produced by reacting ethene with hydrogen sulfide (HS2), according to the shown equation.

The total energy change for this reaction is −69 kJ/mol.The energies of selected bonds are given in the table.

Bond	C–C	CC	C–H	C–S
Energy (kJ/mol)	346	602	411	272

Calculate, to the nearest kilojoule per mole (kJ/mol), the average energy of the S–H bonds in HS2 and ethanethiol.

Q59:

Chloromethane is produced by the reaction of methane (CH)4 with chlorine gas in the presence of UV light. The equation for this reaction is shown.

The reaction of 1.00 mol of methane releases 104 kJ of energy. The energies of selected bonds in the reactants and products are given in the table.

Bond	H–Cl	Cl–Cl	C–H
Energy (kJ/mol)	428	240	411

Calculate, to the nearest kilojoule per mole (kJ/mol), the energy of the C–Cl bond.

Q60:

Shown in the figure are two reactions involving sulfur dioxide (SO2) and sulfur trioxide (SO3). The total energy changes for the reactions, ΔH,are given per mole of SO2 reacted.

The energies of selected bonds are given in the table.

Bond	SO in SO2	OO	FF
Energy (kJ/mol)	533	494	155

Calculate, to the nearest kilojoule per mole, the energy of the SO bond in SO3.

Calculate, to the nearest kilojoule per mole, the energy of the OF bond in OF2.

Q61:

What is the value of the standard enthalpy of formation of any element in its standard state?

Q62:

Methane reacts with oxygen to produce carbon dioxide and water, according to the following equation.

CH()+2O()CO()+2HO()4222gggg

Using the data in the table provided, what is the standard heat of reaction, $\Delta H^{\ominus}$□?Give your answer to the nearest whole number.

$\Delta H^{\ominus}$□CH()(kJ/mol)4g	$\Delta H^{\ominus}$□CO()(kJ/mol)2g	$\Delta H^{\ominus}$□HO()(kJ/mol)2g
−74.86	−393.5	−241.8

Q63:

Which of the following statements best defines the standard enthalpy of formation ($\Delta H^{\ominus}$□)?

- A It is the change in enthalpy for the formation of one mole of a compound from its elements, under standard conditions, and with all elements in their standard state.
- B It is the change in enthalpy for the formation of elements from one mole of a compound, under standard conditions, and with all elements in their standard state.
- C It is the change in enthalpy for the decomposition of one mole of a compound to its elements, under standard conditions, and with all elements in their standard state.
- D It is the change in enthalpy for the reaction of one mole of a compound with one mole of another compound to form a mole of products, under standard conditions, and with all elements in their standard state.
- E It is the change in enthalpy for the formation of one mole of crystal from a saturated solution, under standard conditions, and with all elements in their standard state.

Q64:

The enthalpy change of solution can be determined from the following equation:

$\Delta H = \Delta H + \Delta H + \Delta H$sol□□□

Note that ΔH□ corresponds to the separation of solvent molecules, ΔH□ corresponds to the separation of solute particles, and ΔH□ corresponds to the solvent–solute attractions.

If $\Delta H + \Delta H > \Delta H$□□□,is ΔHsol exothermic or endothermic?

- A Endothermic
- B Exothermic

If $\Delta H + \Delta H < \Delta H \square\square\square$, is ΔHsol exothermic or endothermic?

- A Exothermic
- B Endothermic

If $-\Delta H = -\Delta H = \Delta H \square\square\square$, is ΔHsol exothermic or endothermic?

- A Endothermic
- B Exothermic

Q65:

The process of dissolution can be considered to involve three steps. Which of the following is **not** one of these steps?

- A The separation of solvent–solute interactions
- B The separation of solute–solute attractions
- C The formation of solute–solvent interactions
- D The separation of solvent–solvent intermolecular attractions

Q66:

How much heat, in kilojoules, is released when 0.13 moles of methanol(g) at 64.7∘C are converted to methanol(l)? Take the ΔHvap of methanol to be +35.2 kJ/mol.Give your answer to 2 decimal places.

Q67:

The enthalpy change of solution for NaOH with differing amounts of water is shown.

NaOH()+3HO()NaOH()kJmolNaOH()+300HO()NaOH()kJmolslaqslaq2sol2sol$\Delta H = -28.9 / \Delta H = -42$.3/

What is the enthalpy change of dilution, ΔHdil?

Q68:

Which of the following statements best describes the enthalpy of fusion, ΔHfus?

- A The change in enthalpy resulting from the combining of two atoms to create a molecule

- B The change in enthalpy resulting from the energy released by a substance when burned in oxygen
- C The change in enthalpy resulting from the release of energy by a substance to change its state from solid to gas at constant pressure
- D The change in enthalpy resulting from the taking in of energy by a substance to change its state from solid to liquid at constant pressure
- E The change in enthalpy resulting from the mixing of two solutions together

Q69:

A heating curve for a substance is shown.

Which of the following enthalpy changes corresponds to x on the heating curve?

- A ΔHcond
- B ΔHfus
- C ΔHsol
- D ΔHvap
- E ΔHdil

Which of the following enthalpy changes corresponds to y on the heating curve?

- A ΔHcond
- B ΔHsol
- C ΔHfus
- D ΔHvap
- E ΔHdil

Q70:

What standard enthalpy change can be defined as the enthalpy change when one mole of a substance transforms from a liquid state to a solid state under standard conditions?

- A Standard enthalpy of condensation
- B Standard enthalpy of vaporization
- C Standard enthalpy of solidification
- D Standard enthalpy of fusion

- E Standard enthalpy of sublimation

Q71:

The equation shows the formation of one mole of ethanol, CHOH25,from its constituent elements under standard conditions and with standard states.2C()+3H()+O()CHCHOH()+3O()sgglg22322312

Chemical	Carbon, C()s	Hydrogen, H2	Ethanol, CHOH()25l
Standard Enthalpy of Combustion ($kJ \cdot mol^{-1}$)	−394	−286	−1371

Given the combustion values in the table, calculate the value for the standard enthalpy of formation.

Q72:

Which of the following values is equivalent to ΔH□?

- A $-\Delta H+\Delta H+\Delta H$□□□
- B $-\Delta H-\Delta H-\Delta H$□□□
- C $\Delta H-\Delta H-\Delta H$□□□
- D $\Delta H+\Delta H-\Delta H$□□□
- E $\Delta H+\Delta H+\Delta H$□□□

Q73:

Using Hess's law and the standard enthalpies of combustion in the given table, what is the standard enthalpy of formation of ethane, CH()26g?

Chemical	Carbon, C()s	Hydrogen, H2	Ethane, CH()26g
Standard Enthalpy of Combustion, ($kJ \cdot mol^{-1}$)	−394	−286	−1560

Q74:

Which of the following are necessary to have when calculating the average bond enthalpy of CCl in a molecule of tetrachloromethane, CCl4,using Hess's law?

1. Standard enthalpy change of atomization (C)
2. Standard enthalpy change of atomization (Cl)

3. Standard enthalpy change of formation (Cl2)
4. Standard enthalpy change of formation (CCl4)
5. Standard enthalpy change of combustion (C)
6. Standard enthalpy change of combustion (Cl2)
7. Standard enthalpy change of combustion (CCl4)

- A 1, 2, and 4
- B 4, 5, and 6
- C 1, 2, and 7
- D 5, 6, and 7
- E 2, 3, and 6

Q75:

The enthalpy change of a reaction can be calculated using standard enthalpy change values and also using bond energy data.

Chloropropane can be produced by reacting propane with chlorine gas.Cl()+CH()CHCl()+HCl()23837gggg

Using the standard enthalpies of formation from the table below, what is the standard enthalpy of reaction for the generation of chloropropane?

Chemical	CH()38g	HCl()g	CHCl()37s
Standard Enthalpy of Formation ($kJ \cdot mol^{-1}$)	−105	−92	−133

Using the average bond energies from the table below, what is the enthalpy of reaction for the generation of chloropropane?

Bond	HC	HCl	CC	ClCl	CCl
Bond Energy ($kJ \cdot mol^{-1}$)	410	431	350	242	340

Which of these calculations is considered to be more accurate?

- A The calculation based on standard enthalpies of formation
- B The calculation based on average bond energies

Q76:

Using Hess's law and the standard enthalpies of combustion in the given table, what is the standard enthalpy of formation of heptane (CH())716l?

Chemical	Carbon C()s	Hydrogen H2	Heptane CH()716l
Standard Enthalpy of Combustion ($kJ \cdot mol^{-1}$)	−394	−286	−4817

Q77:

Considering the diagram, which of the following equations would Hess's law predict to be true?

- A $\Delta H = \Delta H - \Delta H$□□□
- B $\Delta H = \Delta H - \Delta H$□□□
- C $\Delta H = \Delta H + \Delta H$□□□
- D $\Delta H = \Delta H + \Delta H$□□□
- E $\Delta H = \Delta H + \Delta H$□□□

Q78:

Using the standard enthalpies of formation in the given table, what is the standard enthalpy of reaction for the decomposition of ammonium chloride?NHCl()NH()+HCl()43sgg

Chemical	NH()3g	HCl()g	NHCl()4s
Standard Enthalpy of Formation ($kJ \cdot mol^{-1}$)	−46	−92	−314

Q79:

Using the diagram and the standard enthalpies of formation in the given table, what is the standard enthalpy of reaction $(\Delta H)\ominus$r for the decomposition of phosphorus pentachloride?

Chemical	PCl()5g	PCl()3g
Standard Enthalpy of Formation ($kJ \cdot mol^{-1}$)	−399	−306

Q80:

When calculating the enthalpy of combustion of ethanol using Hess's law, what value is used for Z?

- A +3 × the enthalpy of formation of water
- B +3 × the enthalpy of combustion of hydrogen

- C +1 × the enthalpy of formation of water
- D −3 × the enthalpy of combustion of hydrogen
- E −3 × the enthalpy of formation of water

Q81:

Subatomic particles can have a charge.

What is the charge of a proton?

- A 1−
- B 1+
- C 2+
- D 0
- E 2−

What is the charge of a neutron?

What is the charge of an electron?

- A 1+
- B 0
- C 2−
- D 1−
- E 2+

Q82:

Which of the following has the smallest mass?

- A An electron
- B A proton
- C A nucleus
- D A neutron
- E An atom

Q83:

What is the mass of an electron as a fraction of the mass of a proton or neutron?

- A 19
- B 1195
- C 17,290
- D 1408
- E 11,840

Q84:

Where is most of the mass of an atom located?

- A In the nucleus
- B In the electron shells
- C In the space between the nucleus and the electron shells

Q85:

Where are the neutrons in an atom?

- A The shells
- B The nucleosome
- C The nuclide
- D The space around the nucleus
- E The nucleus

Q86:

Which particles can be found in the nucleus of an atom?

- A Neutrons and electrons
- B Positrons and electrons
- C Protons and neutrons
- D Positrons and neutrons
- E Protons and electrons

Q87:

Fill in the blanks: An atom is a combination of a dense nucleus, containing and neutrons, and bound in the shells around the nucleus.

- A neutral, protons, electrons
- B negatively charged, electrons, protons

- C negatively charged, positrons, electrons
- D positively charged, protons, electrons
- E neutral, electrons, protons

Q88:

Where are the protons in an atom?

- A The nuclide
- B The space around the nucleus
- C The nucleosome
- D The nucleus
- E The shells

Q89:

Approximately how large is the radius of an atomic nucleus compared to the radius of the atom, R?

- A R
- B $R100$
- C $R100{,}000$
- D $R1{,}000$
- E $R10{,}000$

Q90:

Where are the electrons in an atom?

- A The nuclide
- B The nucleosome
- C The space around the nucleosome
- D The nucleus
- E The space around the nucleus

Q91:

Neon has an atomic number of 10. How many protons are there in an atom of neon?

Q92:

An aluminium atom has an atomic number of 13 and a mass number of 27.

How many protons are there in an atom of aluminium?

- A 27
- B 0
- C 13
- D 14
- E 40

How many neutrons are there in an atom of aluminium?

- A 40
- B 0
- C 14
- D 27
- E 13

How many electrons are there in an atom of aluminium?

- A 40
- B 27
- C 13
- D 0
- E 14

Q93:

A fluorine atom has an atomic number of 9 and a mass number of 19.

How many protons are there in an atom of fluorine?

How many neutrons are there in an atom of fluorine?

How many electrons are there in an atom of fluorine?

Q94:

A carbon atom has an atomic number of 6 and a mass number of 12.

How many protons are there in an atom of carbon?

How many neutrons are there in an atom of carbon?

How many electrons are there in an atom of carbon?

Q95:

An atom of silicon has an atomic number of 14. How many electrons are there in an atom of silicon?

Q96:

An atom of sodium has a mass number of 23. What is the total number of protons and neutrons in the nucleus of the atom?

Q97:

An atom of calcium has a mass number of 42 and an atomic number of 20. How many neutrons are there in its nucleus?

Q98:

An atom of chlorine has a mass number of 35. What is the total number of protons and neutrons in its nucleus?

Q99:

An atom of sulfur has 16 protons in its nucleus. What is the atomic number of sulfur?

Q100:

The atomic number of helium-4 is half its mass number. How many neutrons are there in an atom of helium-4?

Q101:

The “iso” in “isotope” is derived from the Greek word for “equal”. In what way are isotopes equal?

- A They have the same number of protons in their nuclei.
- B They have the same atomic radius.
- C They have the same mass number.
- D They have the same number of neutrons in their nuclei.
- E Their common ions have the same charge.

Q102:

Fill in the blank. Isotopes are atoms with the same number of protons but a different number of .

- A ions
- B nuclei
- C atoms
- D neutrons
- E electrons

Q103:

An atom has 3 protons and 5 neutrons in its nucleus. Which of the following is an isotope of this atom?

- A An atom with 3 protons and 5 neutrons in its nucleus
- B An atom with no protons and 5 neutrons in its nucleus
- C An atom with 4 protons and 4 neutrons in its nucleus
- D An atom with 3 protons and 4 neutrons in its nucleus
- E An atom with 5 protons and 3 neutrons in its nucleus

Q104:

Which of the following is an isotope of magnesium-25?

- A Magnesium-24
- B Magnesium-25
- C Sodium-25
- D Titanium-50
- E Sodium-23

Q105:

Which of the following isotopes is the heaviest?

- A Neon-22
- B Boron-11
- C Hydrogen-3
- D Sodium-21
- E Fluorine-17

Q106:

What does it mean if two atoms are described as isotopes?

- A They are different elements with the same atomic mass.
- B They have the same number of neutrons but different numbers of protons in their nuclei.
- C They have the same number of protons but different numbers of neutrons in their nuclei.
- D They are equally unstable.
- E They are chemically bonded together.

Q107:

Which of the following isotopes is the heaviest?

- A 4018Ar
- B 4418Ar
- C 3919K
- D 4020Ca
- E 4119K

Q108:

Which of the following isotopes is the heaviest?

- A Carbon-12
- B Oxygen-16
- C Nitrogen-15
- D Boron-11
- E Fluorine-15

Q109:

Which of the following is an isotope of carbon-12?

- A Boron-11
- B Carbon-14
- C Nitrogen-15
- D Oxygen-12
- E Oxygen-16

Q110:

An atom has 2 protons and 2 neutrons in its nucleus. Which of the following is an isotope of this atom?

- A An atom with no protons and 2 neutrons in its nucleus
- B An atom with 2 protons and 3 neutrons in its nucleus
- C An atom with 1 proton and 2 neutrons in its nucleus
- D An atom with 2 protons and 2 neutrons in its nucleus
- E An atom with 1 proton and 3 neutrons in its nucleus

Q111:

Which of the following pairs of subatomic particles have an attractive interaction that does **not** involve the strong nuclear force?

- A Electrons and protons
- B Quarks and quarks
- C Protons and neutrons
- D Protons and protons
- E Neutrons and neutrons

Q112:

What is the name of the force that binds neutrons and protons together in the atomic nucleus?

- A Electrostatic force
- B Strong nuclear force
- C Gravitational force
- D Weak nuclear force
- E Magnetic force

Q113:

9440Zr is a stable isotope of zirconium. What is the neutron-to-proton ratio of this isotope?

- A 0.43∶1
- B 1.35∶1
- C 1.74∶1
- D 2.35∶1
- E 0.74∶1

Q114:

How much energy would be produced if an atom with a mass of 2 u was completely converted into energy? Give your answer to 2 decimal places and in units of joules.

- A $1.80\times10^{\square\square}$ J
- B $1.99\times10^{\square\square\square}$ J
- C $9.97\times10^{\square\square\square}$ J
- D $2.99\times10^{\square\square\square}$ J
- E $3.69\times10^{\square\square}$ J

Q115:

The energy needed to ionize a valence electron from an atom of zinc is $1.50\times10^{\square\square\square}$ J.What is this value in electron volts (eV)? Give your answer to 2 decimal places.

Q116:

What is the average binding energy per nucleon in units of mega-electron volts for an atom of lithium-7 with an observed mass of 7.01435 u?Give your answer to 2 decimal places. Take the masses of a proton and a neutron to be 1.00728 u and 1.00866 u respectively.

Q7:

The given plot shows the number of protons and neutrons for all the stable nuclei known to exist.

What name is given to the area of the graph within which all stable nuclei are found?

- A Belt of elements
- B Magic number
- C Valley of decay
- D Strong nuclear zone
- E Band of stability

The orange circle on the plot represents the unstable isotope $^{55}_{13}Cs$.How might this isotope decay to form a more stable nucleus?

- A $\beta^{\square}$ decay
- B α decay
- C Electron capture
- D $\beta^{\square}$ decay
- E Gamma emission

Q8:

Which of the following represents the heaviest and most stable nucleus? What is its number of neutrons?

- A Beryllium, 94Be,5
- B Carbon, 126C,6
- C Tin, 12050Sn,70
- D Thorium, 23290Th,142

Q119:

The given diagram shows the atomic nucleus for an atom of helium containing two protons and two neutrons and the attractive and repulsive forces acting on the particles. What are the names of the attractive and repulsive interactions shown in the diagram?

- A Strong nuclear force and weak nuclear force
- B Magnetism and weak nuclear force
- C Strong nuclear force and electrostatic repulsion
- D Gravitational force and magnetism
- E Van der Waals forces and electrostatic repulsion

Q120:

What is Einstein's equation?

- A $E=mc$□
- B $E=mc$□
- C $E=hc\lambda$
- D $E=h\nu$

Q121:

A composite particle is composed of 2 up quarks and 1 down quark. What is the overall electric charge of this particle?

Q122:

Which of the following denotes the two values of electrical charge a quark can have?

- A +13e and −23e
- B 0 and 12e

- C +1e and −1e
- D −13e and +23e
- E +12e and −12e

Q123:

What electrical charge does an up quark possess?

- A −12
- B +12
- C +23
- D −1
- E −13

Q124:

Which of the following is **not** a type of quark?

- A Bottom
- B Strange
- C Left
- D Up
- E Down

Q125:

Which of the following is composed of 3 quarks in the form uud?

- A A proton
- B An electron
- C Beta particles
- D Alpha particles
- E A neutron

Q126:

Which of the following represents the neutron composition of the quarks inside the nucleus of a helium atom with atomic symbol 42He?

- A 2 neutrons, each composed of 1 down (d) quark and 2 up (u) quarks
- B 4 neutrons, each composed of 1 up (u) quark and 2 down (d) quarks

- C 6 neutrons, each composed of 1 up (u) quark and 2 down (d) quarks
- D 2 neutrons, each composed of 1 up (u) quark and 2 down (d) quarks
- E 2 neutrons, each composed of 3 down (d) quarks

Q127:

Calculate the total number of down quarks in the nucleus of an element that has atomic number 9 knowing that its nucleus contains 28 up quarks.

Q128:

What is the electrical charge of bottom quarks?

- A −23 e
- B +23 e
- C +13 e
- D −13 e
- E −1 e

Q129:

The composition of the neutron from quarks is .

- A udd
- B uuu
- C uud
- D ddd

Q130:

A neutron is electrically neutral because the sum of the quark charges forming it equals zero. Which of the following is the correct combination of quarks in a neutron?

- A 3 down quarks
- B 3 up quarks
- C 1 up quark and 2 down quarks
- D 2 up quarks and 1 down quark

Q131:

Which of the following is **not** a reason why large amounts of ionizing radiation may be harmful to living organisms?

- A Ionizing radiation may inhibit cellular mitosis.
- B Ionizing radiation may reduce the intracellular temperature.
- C Ionizing radiation may trigger cellular apoptosis.
- D Ionizing radiation may have enough energy to break chemical bonds.
- E Ionizing radiation may affect the genetic information carried in cellular DNA.

Q132:

The following questions relate to the ability of different types of ionizing radiation to penetrate various substances.

Which type of ionizing radiation is able to pass through aluminum but is stopped by large quantities of concrete or several centimeters of lead?

- A β particles
- B α particles
- C γ rays

Which type of ionizing radiation is able to pass through paper but is stopped by aluminum sheeting?

- A β particles
- B α particles
- C γ rays

Which type of ionizing radiation could be stopped by a human hand?

- A β particles
- B α particles
- C γ rays

Q133:

Which of the following statements about the deflection of a stream of ionized radiation containing α particles, β particles, and γ rays in a magnetic field is true?

- A α particles and β particles are deflected in the same direction.
- B β particles are not deflected by an electric field.
- C β particles can be deflected back toward the emitter.
- D β particles are only deflected by a small amount compared to α particles.

- E γ rays are deflected in the same direction as β particles.

Q134:

In general terms, why does nonionizing radiation **not** cause permanent damage to living cells?

- A Nonionizing radiation passes straight through living organisms.
- B Nonionizing radiation only travels short distances.
- C Nonionizing radiation does not have enough energy to damage cells.
- D Nonionizing radiation cannot penetrate living cells.
- E Cell exposure to nonionizing radiation is minimal.

Q135:

Which of the following is an example of ionizing radiation?

- A IR rays
- B Cosmic rays
- C Light rays
- D Microwaves
- E Radio waves

Q136:

Identify the incorrect statement relating to deflections in an electric field of a stream of ionized radiation containing α particles, β particles, and γ rays.

- A β particles are deflected less than α particles.
- B An electric field creates a large deflection in the stream of β particles.
- C α particles are deflected in the opposite direction to β particles.
- D γ rays are not deflected by an electric field.
- E The streams of α particles and β particles are separated.

Q137:

Nuclide notation is used to represent different types of ionizing radiation. Which type of ionizing radiation is represented by the nuclide notation 42He?

- A Gamma rays
- B Beta particles
- C X-rays
- D Alpha particles

Q138:

Ionizing radiation has many practical applications. In which of the following devices or processes is ionizing radiation **not** used?

- A Smoke detectors
- B Medical imaging
- C Radars
- D Disinfecting medical instruments
- E Food irradiation

Q139:

Greek letters are used to represent different types of ionizing radiation. Which type of ionizing radiation is represented by α?

- A X-rays
- B Beta particles
- C Gamma rays
- D Alpha particles

Q140:

Which of the following is the correct descending order of different types of radiation according to their penetration power?

- A Gamma rays, neutron particles, beta particles, alpha particles
- B Gamma rays, beta particles, neutron particles, alpha particles
- C Alpha particles, beta particles, neutron particles, gamma rays
- D Gamma rays, beta particles, alpha particles, neutron particles
- E Alpha particles, neutron particles, beta particles, gamma rays

Q141:

Which of the following statements best describes the term *background radiation*?

- A Background radiation is nonionizing radiation emitted from a radioactive source.
- B Background radiation is ionizing radiation emitted from the back of a radioactive source.
- C Background radiation is the measurement of gamma rays emitted from a radioactive source when alpha and/or beta particles are released.

- D Background radiation makes up a small percentage of the count rate measured from a radioactive source.
- E Background radiation is ionizing radiation present in the environment that is not due to a radioactive source.

Q142:

Which of the following statements best defines the concept of half-life?

- A Half the time taken for all of the unstable nuclei to decay
- B The time taken for half of the unstable nuclei to decay
- C The time taken for all of the unstable nuclei to decay
- D Half the time taken for half of the unstable nuclei to decay

Q143:

Two samples, 1 g and 2 g,of the radioactive element radon-222 are compared to each other. Which of the following properties of the two samples are the same?

- A The half-life
- B The volume
- C The number of radon-222 atoms
- D The number of unstable nuclei
- E The amount of radiation emitted every 30 seconds

Q144:

A radioactive isotope with a half-life of 2 hours contains 100 billion unstable nuclei. How many unstable nuclei would remain after 10 hours?

Q145:

Examine the count rate results from a Geiger counter used to measure the radioactivity of a sample for 3 minutes.

Times (s)	0	30	60	90	120	150	180
Count Rate	300	230	184	142	108	92	74

What is the approximate half-life of the sample?

- A Between 0 and 30 seconds
- B Between 90 and 120 seconds

- C Between 60 and 90 seconds
- D Between 30 and 60 seconds
- E Between 120 and 150 seconds

Q146:

Taking the half-life of a sample of nobelium-253 to be 1.62 minutes,how much time would pass until only 1 g of nobelium-253 remained from an initial sample of 32 g?Give your answer to two decimal places.

Q147:

A sample was tested and found to contain 0.32 g of a radioactive substance with a half-life of 4 hours.How much of the substance was present in the sample 20 hours before it was tested?

Q148:

Five radioactive samples are measured over three days,using a Geiger–Müller tube, to provide a count rate. Which of the samples has a half-life of 2 days?

	Day 1	Day 2	Day 3
Source A	1 200	600	300
Source B	100	95	85
Source C	600	420	300
Source D	800	690	550
Source E	1 200	300	75

- A Source D
- B Source A
- C Source B
- D Source E
- E Source C

Q149:

The radioactive decay curve of fermium-253 is shown on the graph.

What is the half-life of fermium-253?

Q150:

Using the decay curve on the graph, find the half-life of the sample.

This lesson includes 15 additional questions and 11 additional question variations when you create an assessment.

Q151:

Using the equation that follows, which type of ionizing radiation, x,was used to bombard beryllium-9 and aid James Chadwick in the discovery of the neutron in 1932?

x+BeC+n9412610

- A Positrons
- B γ rays
- C β particles
- D α particles

Q152:

What is the term used when an atom of one element is converted into an atom of another element?

- A Transmutation
- B Permutation
- C Alchemy
- D Transfiguration
- E Transcription

Q153:

Which of the following equations is correct for atomic transmutation via β decay?

abcdXY+β

- A $d=b-1$
- B $a-c=d$
- C $b=d$
- D $c=a-1$
- E $a=c$

Q154:

Uranium-238, 23892U,is the most common isotope of uranium. Which of the following statements best describes elements that are classified as transuranium?

- A All of the actinoids on either side of uranium
- B All of the lanthanides and actinoids
- C Elements that are in the same group in the periodic table as uranium
- D All of the elements in period 7 of the periodic table
- E Elements that have an atomic number greater than 92

Q155:

Which decay process is represented by the following equation?

85840+1BBe+e

- A Positron emission
- B Beta emission
- C Alpha emission
- D Gamma emission
- E Electron capture

Q156:

The ratio between neutrons and protons in an atom of vanadium-51, 5123V,is approximately 1.22 : 1.

As the number of protons in an atom increases, how does the ratio between neutrons and protons change?

- A The ratio increases until it reaches that in uranium and then decreases.
- B The ratio decreases until it reaches that in uranium and then increases.
- C The ratio increases.
- D The ratio decreases.
- E The ratio increases until it reaches that in uranium and then flattens out.

Q157:

In the following partial equation, the radioactive decay of sodium is shown:2411NaMg+Axy

What values are the correct replacements for x and y?

- A x=24,y=12

- B $x=20, y=9$
- C $x=28, y=13$
- D $x=24, y=10$
- E $x=24, y=11$

What type of ionizing radiation is represented by particle A?

- A Beta particle
- B Alpha particle
- C Positron
- D Gamma ray

Q158:

Which of the following equations represents the beta decay of neptunium-239?

- A $^{239}_{93}\text{Np} \rightarrow ^{235}_{95}\text{Am} + ^{4}_{2}\text{He} + e^{-}$
- B $^{239}_{93}\text{Np} \rightarrow ^{123}_{93}\text{Np} + e^{-}$
- C $^{239}_{93}\text{Np} \rightarrow ^{239}_{94}\text{Pu} + e^{-}$
- D $^{239}_{93}\text{Np} \rightarrow ^{123}_{94}\text{Np} + e^{-}$
- E $^{239}_{93}\text{Np} \rightarrow ^{239}_{92}\text{U} + e^{-}$

Q159:

Which of the following equations represents the α decay of radium-226?

- A $^{226}_{88}\text{Ra} \rightarrow ^{223}_{90}\text{Th} + ^{4}_{2}\text{He}$
- B $^{226}_{88}\text{Ra} \rightarrow ^{230}_{90}\text{Th} + ^{4}_{2}\text{He}$
- C $^{226}_{88}\text{Ra} \rightarrow ^{222}_{86}\text{Rn} + ^{4}_{2}\text{He}$
- D $^{230}_{90}\text{Th} \rightarrow ^{226}_{88}\text{Ra} + ^{4}_{2}\text{He}$
- E $^{226}_{88}\text{Ra} \rightarrow ^{228}_{86}\text{Rn} + ^{4}_{2}\text{He}$

Q160:

Which subatomic particle (A) is emitted when the following unstable isotope of fluorine decomposes?

$^{178}_{89}\text{F} \rightarrow ^{178}_{90}\text{O} + \text{A}$

- A Neutron
- B Quark

- C Electron
- D Positron
- E Proton

Q161:

In solar fusion reactions, how many hydrogen nuclei must fuse to create one helium nucleus and two positrons?

- A 5 hydrogen nuclei
- B 1 hydrogen nucleus
- C 3 hydrogen nuclei
- D 4 hydrogen nuclei
- E 2 hydrogen nuclei

Q162:

What is the name of the rods used to absorb neutrons and slow down the reaction in a nuclear reactor?

- A Graphite rods
- B Control rods
- C Reaction rods
- D Meltdown rods
- E Fuel rods

Q163:

In the following example of nuclear fission, what else is produced but is not shown in the chemical equation?235921014156923610U+nBa+Kr+3n

- A Quarks
- B Beta particles
- C Cosmic rays
- D Energy
- E Alpha particles

Q164:

Although it is carefully controlled, once nuclear fission is initiated in a nuclear reactor, the reaction continues indefinitely until the fuel rods are spent. What is the name for a reaction of this type?

- A Neutron reaction
- B Decay reaction
- C Geiger reaction
- D Chain reaction
- E Fusion reaction

Q165:

Consider the following example of nuclear fission:235921014256913610U+Ba+Kr+3Xn

Which subatomic particle is represented by X?

- A An electron
- B A positron
- C A quark
- D A proton
- E A neutron

Q166:

Fill in the blank: The process by which energy is released from the core of the sun is known as .

- A chain reaction
- B nuclear radiation
- C nuclear fission
- D nuclear decay
- E nuclear fusion

Q167:

Which of the following statements correctly contrasts nuclear fusion and nuclear fission?

- A In nuclear fission, large nuclei split, while in nuclear fusion, small nuclei combine.
- B In nuclear fusion, large nuclei split, while in nuclear fission, small nuclei combine.

Q168:

In a nuclear reactor, it is important that the reaction does not proceed too quickly or too slowly.

What is the name of the process by which neutrons are slowed down to ensure more successful collisions occur?

- A Neutron transmutation
- B Neutron absorption
- C Neutron ionization
- D Neutron moderation
- E Neutron activation

What is the name of the process by which neutrons are blocked to prevent collisions with the fuel rods?

- A Neutron activation
- B Neutron transmutation
- C Neutron moderation
- D Neutron absorption
- E Neutron ionization

Q169:

The following equation shows the possible fragments in a nuclear fission reaction:

23592101485710U+nLa+Z+3nxy

Which value correctly corresponds to x?

Which value correctly corresponds to y?

What element is Z?

- A Selenium
- B Bromine
- C Krypton
- D Arsenic
- E Rubidium

Question :

On adding a littel amount of conc. supluric acid to a beaker containing an amount of water, the temperature of water increases.

Then the reason for rhat Increase Is:

- Separation energy of solute and solvent is greater than heat of hydration.
- Separation energy of solute and solvent is less than heat of hydration.
- Ions separation energy is less than heat of hydration.
- Ions separation energy is greater than heat of hydration.

Taking this example, we will notice that answering the question requires tmany skills, the most important of which are:

Determining the required; cause of the increase of water temperature when adding concentrated sulfuric acid.

dentifing the given; solvent energy, dissolved energy, lonizing energy, reactive energy
Think about the difference between alternatives and agreements

There are three factors that affect lons separation

1- Detach dissolved molecules leads to absorption of energy
2- Separation of the solvent molecules absorbs energy as well
3- The connection of water to the solvent produces its energy

Answer :

On adding a littel amount of conc. supluric acid to a beaker containing an amount of water, the temperature of water increases.

Then the reason for rhat increase is:

- Separation energy of solute and solvent is greater than heat of hydration.
- Separation energy of solute and solvent is less than heat of hydration.
- Ions separation energy is less than heat of hydration.
- Ions separation energy is greater than heat of hydration.